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has recently stated that the same grottoes contain the bones of forty-two species of birds, fourteen of them birds of prey, the others the food-birds of the primitive race who inhabited the caves. One species only is extinct, but many have disappeared from the region they then inhabited. The quail, which is now common on the Mediterranean coasts, is seen in the Mentone grottoes.

The batrachians of the Mentone grottoes are a species of toad, which no longer exists in France, and in dimensions is near the large *Bufo agua* of South America, and a frog, while seven species of fish occur, one extinct and six still living. The extinct species belongs to Strophodus, a Jurassic genus of sharks. Among the recent species are the maigre, tunny, salmon, and trout. Altogether, in the six caverns once inhabited by quaternary man, M. Gaudry reports eight hundred and forty thousand fragments, vertebrate and invertebrate, belonging to one hundred and eleven species of the former category and one hundred and seventy-one of the latter.

RECENT.—Professor J. D. Dana, in a recent article in the *American Journal of Science*, concludes, in connection with the recent disturbances at Kilauea, Vesuvius, and Tarawera, that volcanic action must be attributed to the hydrostatic pressure of the column of lava; the pressure of vapors escaping in underground regions from the lavas, or produced by contact with them, acting either quietly or catastrophically; and the pressure of the subsiding crush of the crust forcing up the lavas in the conduit.

MINERALOGY AND PETROGRAPHY.[1]

Petrographical News.—The rocks occurring in equatorial Eastern Africa (Massai-Land) have been found by O. Mügge[2] to embrace granophyres, gneisses, mica schists, and amphibolites among the older rocks, and liparites, trachytes, nephelinites, nepheline-tephrites and basanites, limburgites, melilite-basalts, augite andesites and feldspathic basalts among the younger ones. The granophyres contain an augite with partings parallel to $\infty P\bar{\infty}$ and $0P$, hypersthene and hornblende, all of which are so closely and peculiarly associated that the author thinks they might be due to the solution in the granophyre substance of some foreign inclusion. The gneisses, schists, and amphibolites also contain a diallagic and an orthorhombic augite. Among the granular constituents of two specimens of amphibolite, prismatic crystals of scapolite were noticed. The porphyritic feldspathic constituent of the trachytes (acmite-trachytes) corresponds very closely to the soda-microcline of Förstner.[3]

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[1] Edited by Dr. W. S. BAYLEY, Madison, Wisconsin.

[2] Neues Jahrb. fr. Min., etc., Beil. Bd., iv. p. 576.

[3] *Cf.* American Naturalist, Notes, June, 1885, p. 600.

Wollastonite and melanite, which were observed in some of the nephelinites, Mügge thinks must be looked upon as having crystallized directly from the magma of the rock itself, and not as the result of the solution of inclusions. Unfortunately, the author was not able to study these rocks in the field, so that their geological relations are not definitely known.——Bruno Doss[1] has recently made a very thorough investigation of the igneous rocks of Palestine, and as a result of his studies declares them to be labradorite basalts. Their olivine constituent occurs both in porphyritic crystals and in the ground-mass. The two generations are distinguished by the marked differences in their mode of alteration. The mineral of the first generation contains more iron than that of the second, and accordingly gives rise to decomposition products consisting principally of red iron compounds insoluble in acids, while the latter class are merely serpentinized. Twins of olivine were observed in which the twinning planes are $P\check{\infty}$, and in less frequent instances ∞P. In three specimens pseudobrookite was detected.——The fact that quartz and olivine may occur in the same rock is given additional interest by the discovery in Northern California of a quartz-basalt. This rock is described by Mr. Diller[2] as possessing all the essential characteristics of ordinary basalts, with the addition besides of numerous grains of quartz, many of which are surrounded by a zone of glass and pyroxene. From the fact that quartz is also found in bombs, which must have existed as clots in the lava at the time of its eruption, Mr. Diller is forced to assume that the same magma which under ordinary conditions of temperature and pressure yielded olivine, under different conditions secreted quartz. This quartz-basalt is younger than the ordinary basalts of the region, just as the dacites are younger than the andesites. ——The origin of lithophysæ in the acid lavas of the Yellowstone National Park is the subject of a paper by Mr. Iddings[3] in a late number of the *American Journal of Science.* In it the author inclines to the theory first proposed by Von Richthofen, viz., that this structure is of aqueo-igneous origin, and was produced by the action of absorbed gases upon the molten glass, from which they were liberated during the crystallization consequent upon cooling. Mr. Iddings is led to this view by the facts (1) that the minerals found upon the walls of the lithophysæ (quartz, tridymite, and fayalite) are those which have been produced artificially only by aqueo-igneous methods, and (2) that the chemical composition of the substances of lithophysæ and of spherulites is essentially the same, and therefore the former cannot have been produced by the alteration of the latter.[4]——Chrustschoff[5] has isolated zircon from gneisses, granites, trachyte, basalt, sanidine bombs, and graywackes, and has described the characteristic peculiarities of crystals obtained from these different sources. He has found that the crystals occurring in gneisses always present rounded contours, while those in granite are always defined by sharp crystal planes. He proposes to make use of this fact in distinguishing gneisses with granitic habit from true granites.

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[1] Min. u. Petrog. Mitth., vii., 1886, p. 461.

[2] Amer. Jour. Sci., Jan. 1887, p. 45.

[3] Ib., Jan. 1887, p. 36.

[4] *Cf.* American Naturalist, Notes, Jan. 1887, p. 70.

[5] Min. u. Petrog. Mitth., vii., 1886, p. 423.

Mineralogical News.—*Kaliophilite* is the name proposed by Mierish[1] for a new mineral occurring in colorless needles in one of the Monte Somma bombs examined by him in the course of his work referred to in the March number of this journal. It is a potassium nepheline. An analysis yielded,—

SiO_2	Al_2O_3	CaO	K_2O	Na_2O
37.48	32.43	2.18	27.20	2.26

The author supposes that ordinary nepheline may consist of mixtures of the isomorphous molecules $K_2Al_2Si_2O_8$ and $Na_2Al_2Si_2O_8$, since this mineral always contains more or less potassium. The group of nephelines is now known to consist of at least three members, the third being the mineral eucryptite, discovered by Brush and Dana[2] among the alteration products of spodumene. ——*Scapolite.*—In no manner can the difference in the views of the two schools of mineralogical chemists be better learned than by an examination of the papers relating to the discussion now being carried on in Germany and Austria in regard to the nature of the scapolite group of minerals. In an article in the *Neues Jahrbuch*, Rammelsberg[3] gives his reason for considering this group of minerals as consisting of molecular combinations of normal- (meta-), half- (ortho-), and di- (bi-) silicates of sodium, calcium, and aluminium in certain definite proportions. *Sarkolite*, for instance, he regards as a molecular compound made up of the three ortho-molecules in the proportions $3Na_4SiO_4$, $27Ca_2SiO_4$, $10Al_4(SiO_4)_3$; and *Meionite*, from Mt. Vesuvius, as a similar compound, in which the meta-silicates are present in the proportions of one molecule to six of the ortho-silicates, as,—

$$6\left\{\begin{array}{l} Na_4SiO_4 \\ 6\left\{\begin{array}{l} 4Ca_2SiO_4 \\ 3Al_4(SiO_4)_3 \end{array}\right. \end{array}\right\} + \left\{\begin{array}{l} Na_2SiO_3 \\ 6\left\{\begin{array}{l} 4CaSiO_3 \\ 3Al_2(SiO_3)_3 \end{array}\right. \end{array}\right\} + 20NaCl.$$

Tschermak,[4] on the other hand, regards the members of this group (like those of the plagioclase group) as isomorphous mixtures of the two molecules $4CaO,3Al_2O_3.6SiO_2 = Ca_4Al_6Si_6O_{25}$ and $Na_8Al_6Si_{18}O_{48}Cl_2 = 3Na_2O,3Al_2O_3,18SiO_2 + 2NaCl$, which he calls respectively the meionite and mariolite molecules. By the combination of these two molecules in different proportions the various members of the group are formed, and by calculation the proportionate amounts of each present in any given case can readily be determined from the amounts of calcium and sodium found by analysis.——*Bastonite*, a micaceous mineral characterizing certain sandstones and arkoses, is supposed by Renard to be very similar to vermiculite, which Tschermak regards as an altered phlogopite. Its analysis yielded Klement,[1]—

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[1] Tschermak's Min. u. Petrog., Mitth. viii., 1886, p. 156.

[2] Amer. Jour. Sci., III. xx., 1880, p. 257.

[3] Neues Jahrbuch f. Min., etc., Beil. Band, iv., 1886, p. 610; also Sitzb. Berl. Akad., Bd. 30, p. 589.

[4] Min. u. Petrog. Mitth., vii., 1886, p. 400.

SiO_2	Al_2O_3	Fe_2O_3	FeO	MnO	CaO	MgO	K_2O	Na_2O	H_2O
36.91	20.04	20.01	3.73	trace	0.95	7.96	3.07	0.22	6.98

——According to the investigations of Nordenskiöld,[2] the peculiar fluid inclusions in Brazilian topaz, to which Dana gave the name "brewsterlinite," are, at least in some cases, inclusions of a hydrocarbon, probably of the naphtha group.——Schuster[3] has discovered that the *braunite* from the manganese mines of Jakobsberg, in Wermland, Sweden, is probably isomorphous in crystallization with hematite and ilmenite. Its analysis yielded Igelström,[4]—

SiO_2	MnO	FeO	$MgO.CaO$	PbO	O
8.7	80.23	1.33	0.95	8.65	8.17

If the iron, magnesium, calcium, and lead be supposed to replace manganese, the composition of the mineral may be represented by the formula $11Mn_2O_3.3MnSiO_3$, corresponding very nearly to the result reached by Rammelsberg in his analysis of the braunite from Elgersburg.

Crystallographic News.—Recent measurements of crystals of *vanadinite* from Pinal County, Arizona, have yielded Mr. Penfield[5] results agreeing closely with those obtained by Urba[6] in his investigations of Carinthian crystals. *Endlichite*[7] [$Pb_5Cl(AsO_4)_3 + Pb_5Cl(VO_4)_3$] from the Sierra Grand Mine, Grant County, New Mexico, was also examined. The axial ratio, as determined by Penfield, is $a:c = 1:.7495$. The presence of arsenic in the mineral seems to tend to increase very perceptibly the length of the vertical axis as compared with that of the pure vanadium mineral (in vanadinite $a:c = 1:.7112$).——The new forms 2O, 1 1O6, and 6O4 have been observed by E. S. Dana[8] on crystals of native *copper*. In the same paper the author describes crystals which, by development in certain directions, assume the rhombohedral symmetry. The twinning laws of copper are also investigated, and the article concludes with plates containing fiftyfour illustrations of copper crystals and crystal groupings.——From new measurements of crystals of *hyalosiderite*, the iron-rich olivine, and *forsterite*, the pure magnesian variety, Max Bauer[1] has recalculated the axial relations of these minerals. For the first he finds $\check{a}:\bar{b}:\acute{c} = .46815:1:.58996$; for the second, $\check{a}:\bar{b}:\acute{c} = .46476:1:.58569$. On comparing these ratios with those obtained from measurements made on *fayalite*, the pure iron olivine, and other members of this series, the composition of which is known, it is found that an increase in the amount of the magnesium molecule present in any case is accompanied by a shortening of the $\check{a}$ and $\acute{c}$ axes as compared with the $\bar{b}$ axis.——In the same article Bauer describes twinning lamellæ in massive *barite* from several localities in Germany. The twinning plane is $6P\bar{\infty}$. He regards them as pressure twins like those found in calcite, cyanite, sphene, etc.

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[1] Min. u. Petrog. Mitth., viii., 1886, p. 1.

[2] Neues Jahrb. f. Min., etc., 1886, i. p. 242.

[3] Min. u. Petrog. Mitth., vii., 1886, p. 443.

[4] Annales des Mines de Wermland, 1884, p. 73.

[5] Amer. Jour. Sci., December, 1886, p. 441.

[6] Zeitschrift f. Kryst., iv. p. 353.

[7] American Naturalist, Notes, July, 1885, p. 709.

[8] Amer. Jour. Sci., December, 1886, p. 413.

Miscellaneous.—In the January number of the *American Journal of Science*[2] Mr. G. F. Becker has an interesting article on "The Texture of Massive Rocks." The subject is treated theoretically, and in such a manner that a brief synopsis of it would be most unsatisfactory. Suffice it to state here that Mr. Becker supposes the formation of plutonic granitoid rocks to represent an extreme and highly exceptional case of neutral chemical equilibrium in a pasty magma, by the cooling of which they were derived. As a rule, however, he regards granular structure as characteristic of metamorphosed sediments.[3] Porphyrite structure is the natural result of slow cooling of a very fluid magma, and is merely the evidence of fractional crystallization of the various minerals. These conclusions are based on a theory of the solidification of minerals in accordance with certain laws of thermo-chemistry.[4]——In a letter to the *Neues Jahrbuch für Mineralogie*,[5] A. Schrauf explains his views on morphotropism and atometrie, which, so far as they relate to minerals, are briefly as follows. The form of crystallization of chemical mixtures depends principally upon the various amounts of their constituents. $MgSO_4 + 7H_2O$ (epsomite) crystallizes in the orthorhombic system, while $FeSO_4 + 7H_2O$ (melanterite) is monoclinic. Mixtures of $MgSO_4 + 7H_2O$ and $FeSO_4 + 7H_2O$ crystallize in the latter system until the proportion of magnesium in the mixture is to the amount of iron as three atoms to one atom $(3MgSo_4 + FeSo_4) + 7H_2O$, when it crystallizes in the orthorhombic system,—*i.e.*, the crystallization is determined by that substance which is in excess (by weight). In the compound $(3MgSo_4 + FeSo_4) + 7H_2O$ the Mg and

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[1] Neues Jahrb. f. Min., 1887, i. p. 1.

[2] Amer. Jour. Sci., January, 1887, p. 50.

[3] *Cf.* American Naturalist, Notes, December, 1886, p. 1050.

[4] Amer. Jour. Sci., 1886, p. 120.

[5] Neues Jahrb. f. Min., 1886, i. p. 234.

Fe are to each other as 72 : 56, Mg is in excess, and the substance crystallizes as does $MgSo_4 + 7H_2O$. In compounds containing less Mg (as $2MgSo_4 + FeSo_4) + 7H_2O$, the proportions of Mg and Fe are as 48 : 56, and the crystallization is that of melanterite. Various conditions effect the crystallization of mixed bodies, but the most important of these, according to Schrauf's opinion, is the one mentioned above. If this law is found to be general in its application, the present views in regard to the dimorphism of many compounds belonging to the so-called iso-dimorphous groups will have to be modified.

BOTANY.[1]

Botanical Manuals for Students.—Nowadays we are urging students to collect and study plants from all the great groups, and thereby to familiarize themselves with the vegetable kingdom as a whole, but perhaps we too often overlook the difficulties which lie before them. Not the least of these is the want of systematic manuals in which descriptions of the genera and species may be found. It is all very well to tell a student that the name and technical description are of much less importance than is the knowledge of structure and habits. It is true, no doubt, but, for all that, there is need of such works in every laboratory, to serve *as guides*, if for no other purpose. Unfortunately for the American student, we are as yet poorly supplied with descriptive manuals. In the following list I have enumerated the classes (and in some cases the orders under the classes) of the several great branches of the plant kingdom, giving for each the name of a useful systematic manual. I have not attempted to make a list of the works of this kind which are *absolutely the best*, for too often such works are too expensive for the limited means of the botanical departments of many schools and colleges.

PROTOPHYTA.

MYXOMYCETES.—Cooke's Myxomycetes of Great Britain.

SCHIZOMYCETES.—Grove's Bacteria and Yeast Fungi.

CYANOPHYCEÆ.—[2] Cooke's British Fresh-Water Algæ, pp. 203–282, and, doubtfully, pp. 1–30.

ZYGOPHYTA.

ZOOSPOREÆ.—Cooke's British Fresh-Water Algæ, pp. 67 (Pandorina), 35–49 (Hydrodictyon, etc.), 135–145 (Confervaceæ); and Farlow's New England Algæ, pp. 41–44 (Ulvaceæ), and 61–98 (Phæosporeæ).

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[1] Edited by Prof. CHARLES E. BESSEY, Lincoln, Nebraska.

[2] During the year the work on the "Fresh-Water Algæ of North America," by Francis Wolle, may be expected. When that appears it should be substituted for the "British Fresh-Water Algæ" wherever the latter occurs in this list.